Chapter 3. Planning Data and Demand Forecast

This chapter presents information on demographics and water demands for Everett's regional water system. Data from recent years are reviewed and a forecast of future demand through 2040 is presented. The *2014 Addendum to the 2007 CWP* provided historical data through 2012. Therefore, historical data in the 2020 CWP cover years 2013–2018. Complete data for 2019 were not available at the time of development and were not incorporated into the analysis.

The period analyzed for the demand forecast assumes that 2020 is the base year, 2030 is year 10, and 2040 is year 20.

3.1 Customer Categories and Characteristics

Everett serves potable water directly to residential, commercial, and other customers throughout the Everett retail service area. Most of the retail service area is within Everett city limits. A small percentage of the direct retail connections served by Everett are located outside of the Everett retail service area. These connections are located along the various water transmission pipelines operated by Everett. A small portion of the retail service area lies outside of city limits and a small portion of the city is not served by the Everett water system.

Since the 2014 CWP Addendum, Everett has modified customer class categories in its billing system. Retail connections are categorized into the following 12 primary billing classes:

1. **Single-family residential:** This billing class includes metered and non-metered single-family household connections inside and outside of Everett city limits. This billing class excludes specific irrigation connections identified in the single-family irrigation billing class.
2. **Multifamily residential:** This billing class includes all multifamily housing, from duplexes to large apartment complexes inside and outside of Everett city limits. This billing class excludes specific irrigation connections identified in the multifamily irrigation billing class.
3. **Commercial and industrial:** This billing class includes most of the non-residential connections served by Everett inside the city limits. This billing class excludes specific irrigation connections identified in the commercial and industrial irrigation billing class.
4. **Outside city commercial and industrial:** This billing class includes non-residential connections served by Everett outside the city limits.
5. **City of Everett:** This billing class represents connections to City-owned facilities.
6. **City of Everett irrigation:** This billing class includes separate irrigation meters installed at City-owned properties.
7. **Fire service:** This billing class includes charges for standby capacity for fire requirements.
8. **Outside city fire service:** This billing class includes charges for standby capacity for fire requirements outside the city limits.

9. **City of Everett fire service; City of Everett fire service/non-self-supplied:** This billing class is fire service used by facilities in the Everett retail service area or rented out to others.
10. **Government:** This billing class represents connections to public-sector accounts, such as schools; parks; and local, state, and federal government offices or facilities in city limits.
11. **Outside city government:** This billing class represents connections to public-sector accounts, such as schools; parks; and local, state, and federal government offices or facilities located outside city limits.
12. **Irrigation:**

12a. **Multifamily and single-family irrigation:** This category includes separate irrigation meters installed at some multifamily customer and single-family customer sites.

12b. **Commercial and industrial irrigation:** This billing class represents connections to commercial or industrial sites for irrigation purposes. This does not include irrigation connections for multifamily households or city irrigation.

12c. **Outside city commercial irrigation:** This billing class represents select connections to commercial sites for irrigation purposes outside city limits.

12d. **Government Irrigation:** This billing class represents connections to public-sector accounts, such as schools; parks; and local, state, and federal government offices or facilities for irrigation purposes.

12e. **Outside city government irrigation:** This billing class represents connections to public-sector accounts, such as schools; parks; and local, state, and federal government offices or facilities serving irrigation purposes located outside city limits.

Additionally, Everett provides water to numerous wholesale water customers. Each of these customers is a public water system that delivers water to residences and businesses through its own local distribution system. Wholesale customers are listed in Appendix G.

Table 3-1 lists the approximate number of connections with measured water sales by billing class for years 2013 through 2018.

Table 3-1. Retail Potable Water Connections

Customer Class	Approximate Number of Connections					
	2013	2014	2015	2016	2017	2018
Single family (metered)	7,041	7,975	9,474	11,591	14,408	16,180
Single family (flat/non-metered)	12,134	11,320	10,008	8,032	5,518	3,935
Single family outside city (metered)	1,490	1,488	1,498	1,530	1,535	1,542
Single family subtotal	**20,665**	**20,783**	**20,980**	**21,153**	**21,461**	**21,657**
Multifamily	3,203	3,212	3,244	3,235	3,236	3,250
Multifamily outside city	34	35	36	36	39	38
Multifamily subtotal	**3,237**	**3,247**	**3,280**	**3,271**	**3,275**	**3,288**
Commercial	1,894	1,891	1,887	1,885	1,881	1,916
Commercial outside city	16	16	15	15	15	16
Industrial	37	37	38	37	36	37

Customer Class	Approximate Number of Connections					
	2013	2014	2015	2016	2017	2018
Commercial/industrial subtotal	**1,947**	**1,944**	**1,940**	**1,937**	**1,932**	**1,969**
City of Everett	40	40	41	41	41	42
City of Everett streets sewer	14	14	13	16	16	16
City of Everett parks	11	11	11	11	11	11
City of Everett irrigation	43	45	46	48	49	46
City of Everett: not self-consumed	2	2	2	2	2	2
City of Everett fire service: not self-consumed	1	1	1	1	1	1
City of Everett fire service	11	11	11	11	11	11
Fire service	714	721	727	729	743	756
Fire service outside city	5	5	3	3	3	3
Government	105	105	103	102	99	101
Government outside city	1	1	1	1	1	1
Domestic irrigation	139	138	138	144	145	144
Single family irrigation	1	1	1	1	2	2
Government irrigation	55	53	53	52	50	51
Industrial irrigation	2	3	3	3	3	3
Commercial irrigation	275	283	286	292	301	303
Commercial irrigation outside city			2	2	1	1
Government irrigation outside city	1	1	1	1	1	1
Kimberly-Clark (untreated)	0					
Kimberly-Clark	1	1	0			
Wholesale Customers						
Alderwood Water & Wastewater District	3	3	3	3	3	3
City of Marysville	1	1	1	1	1	1
City of Snohomish	5	5	5	5	5	5
City of Monroe	3	3	3	3	3	3
Snohomish County PUD	13	13	13	13	12	12
Silver Lake Water & Sewer District	2	2	2	2	2	2
Tulalip Utilities					1	1
Mukilteo Water & Wastewater District	3	3	3	2	2	2
Other Group A water systems [a]	38	37	37	37	37	37
Group B water systems [b]	60	60	60	60	60	60
Totals	**27,398**	**27,537**	**27,770**	**27,947**	**28,274**	**28,535**

Group A water systems serve 15 or more connections or 25 or more customers.

Group B water systems serve 14 or fewer connections or 24 or fewer customers.

3.2 Historical Retail Service Area Population

Table 3-2 displays the recent historical population estimates for the Everett retail service area. Population estimates for 2013–2018 within the city limits are provided by the Washington State Office of Financial Management (OFM). Population estimates for the retail service area outside the city limits were developed as follows:

- **Single-family:** Multiplied number of single-family residential connections outside city limits by an assumed average household population (2.5 persons per household) to estimate total population served by single-family residential connections outside city limits.
- **Multifamily:** Estimated an average number of units per multifamily connection using data from the City of Everett Comprehensive Plan. Multiplied total multifamily connections outside city limits by estimated number of units and an assumed average multifamily unit population (1.8 persons per unit) to estimate total population served by multifamily residential connections outside city limits.

Single-family and multifamily population estimates were added to determine total retail service area population outside the city limits.

Table 3-2. Population Estimates for Everett's Retail Service Area (2013–2018)

	Population Estimates					
	2013	2014	2015	2016	2017	2018
Inside city total [a]	**104,200**	**104,900**	**105,800**	**108,300**	**109,800**	**111,200**
Outside City Estimates						
Single-family connections [b]	1,490	1,488	1,498	1,530	1,535	1,542
Single-family occupancy (persons per household)	2.5	2.5	2.5	2.5	2.5	2.5
Single-family population	3,725	3,720	3,745	3,825	3,838	3,855
Multifamily connections [b]	34	35	36	36	39	38
Multifamily units/connection [c]	8	8	8	8	8	8
Multifamily occupancy (persons per unit)	1.8	1.8	1.8	1.8	1.8	1.8
Multifamily population	495	510	524	524	568	553
Outside city total	4,220	4,230	4,269	4,349	4,406	4,408
Total retail population	**108,420**	**109,130**	**110,069**	**112,649**	**114,206**	**115,608**

[a] Source: Washington State OFM.

Source: City of Everett billing data.

Source: City of Everett Comprehensive Plan, Land Use Element Section III. A. #16.

3.3 Historical Water Consumption

This section presents historical water production and sales data. Production refers to water produced at the WFP, while sales represents water delivered to customers (retail and wholesale; includes estimated deliveries to non-metered customers). This section also assesses non-revenue water, which is the difference between water production and sales.

3.3.1 Production

Water produced at the WFP for the period from 2013 to 2018 is displayed in Table 3-3.

Table 3-3. Historical Water Production for Retail and Wholesale Distribution (2013–2018)

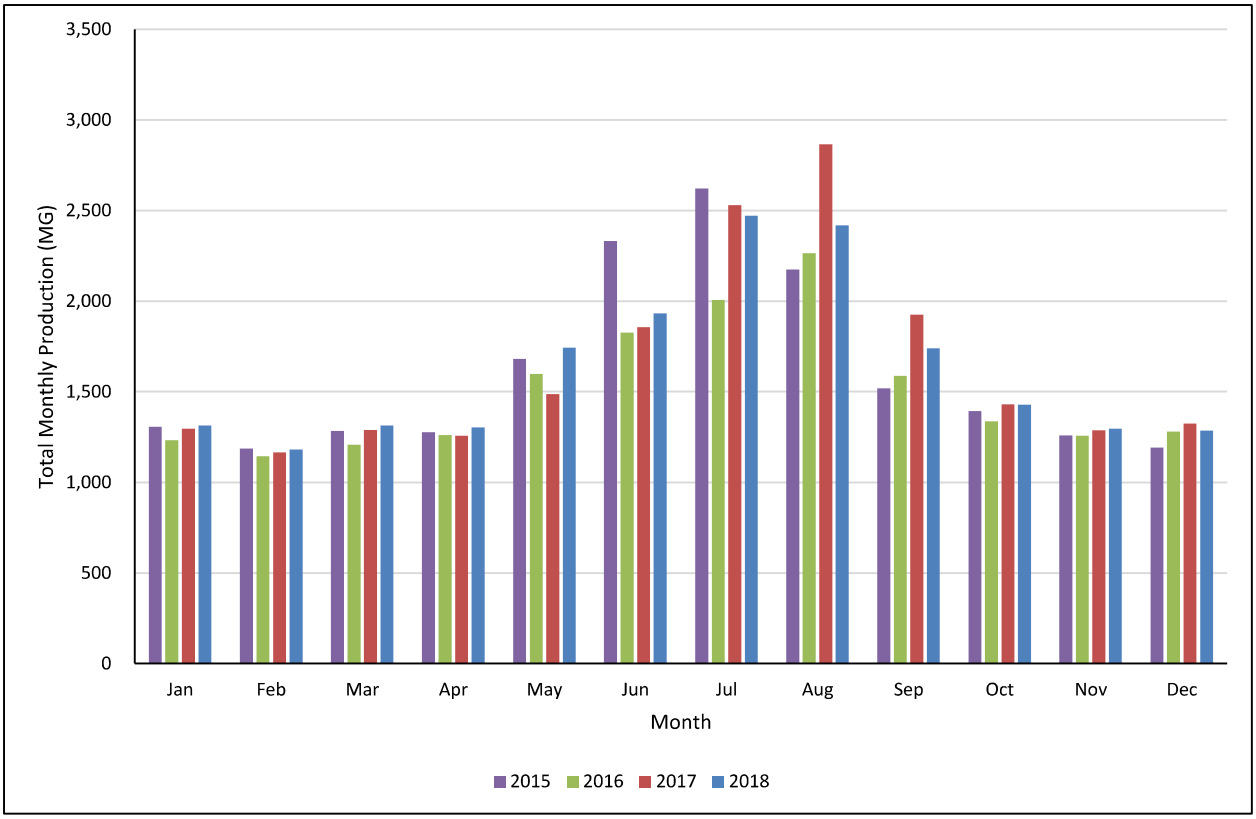
Month	Water Production (MG)							
	2013	2014	2015	2016	2017	2018	6-year Average	3-year Average
January	1,300	1,251	1,307	1,234	1,296	1,314	1,284	1,281
February	1,149	1,134	1,187	1,145	1,165	1,182	1,160	1,164
March	1,275	1,267	1,284	1,208	1,289	1,314	1,273	1,270
April	1,240	1,267	1,276	1,262	1,258	1,303	1,268	1,274
May	1,483	1,455	1,682	1,598	1,488	1,744	1,575	1,610
June	1,728	1,747	2,332	1,827	1,857	1,932	1,904	1,872
July	**2,316**	**2,283**	**2,622**	2,008	2,530	**2,471**	**2,372**	2,336
August	2,108	2,124	2,176	**2,265**	**2,866**	2,418	2,326	**2,516**
September	1,528	1,653	1,518	1,588	1,927	1,740	1,659	1,752
October	1,326	1,353	1,393	1,337	1,429	1,428	1,378	1,398
November	1,265	1,257	1,260	1,257	1,288	1,296	1,271	1,281
December	1,311	1,317	1,192	1,280	1,325	1,285	1,285	1,297
Total annual production	18,031	18,110	19,229	18,010	19,717	19,427	18,754	19,051
Max day production (mgd)	82.4	85.0	98.4	82.9	102.5	90.9	90.4	92.1
Average day production (mgd)	49.4	49.6	52.7	49.2	54.0	53.2	51.4	52.2
Peaking factor	1.67	1.71	1.87	1.68	1.90	1.71	1.76	1.76

Note: Bold numbers represent peak production month.

Total annual production fluctuates from year to year and displays no discernible trend of increase or decrease from 2013 through 2018 (no consistent trends between 3- and 6-year averages). During that time, more than 1,000 connections and over 7,000 people have been added to the retail service area (Table 3-1 and Table 3-2 above), indicating that water use trends over this period have not followed population trends, perhaps indicating that other factors have had a larger impact on overall water demand (climate, conservation, etc.), and that per capita water use is generally decreasing. This pattern is observed in water systems throughout the region.

Production has a distinct seasonal pattern where sales in July and August rise to approximately 80 percent higher than in January. This seasonal increase in demand is typical among water utilities in northern climates because of increased outdoor water uses during the summer. Figure 3-1 displays monthly water production for 2015–2018, which graphically reveals the seasonal production trends.

Figure 3-1. Monthly Water Production, 2015–2018



Water demand peaking factor is defined as the value of maximum day production (or maximum day demand [MDD]) in a year divided by the same year's average day production (or average day demand [ADD]). The peaking factor represents the highest water demand that water utilities typically need to serve during summer months because of increased outdoor use by customers. The data in Table 3-3 above suggest that Everett's peaking factor is generally stable, ranging from 1.67 to 1.90. The average peaking factor over the last 3- and 6-year periods is 1.76. Therefore, a peaking factor of 1.76 was selected as the peaking factor for the 2020 CWP planning horizon. This is nearly identical to the peaking factor in the 2014 CWP Addendum (1.75).

3.3.2 Water Sales

Water sales represent water delivered to customers (metered and unmetered) from the WFP for their consumption. Water sales to retail customers are divided by customer classes. Water sales to wholesale customers are measured at the delivery point and are distributed to end users through the receiving system's distribution network.

Retail

Table 3-4 presents annual retail water sales by customer class from 2013–2018. Figure 3-2 graphically depicts the relative proportion of the retail demand consumed by each customer class.

Table 3-4. Water Sales by Customer Class in Everett's Retail Service Area (2013–2018)

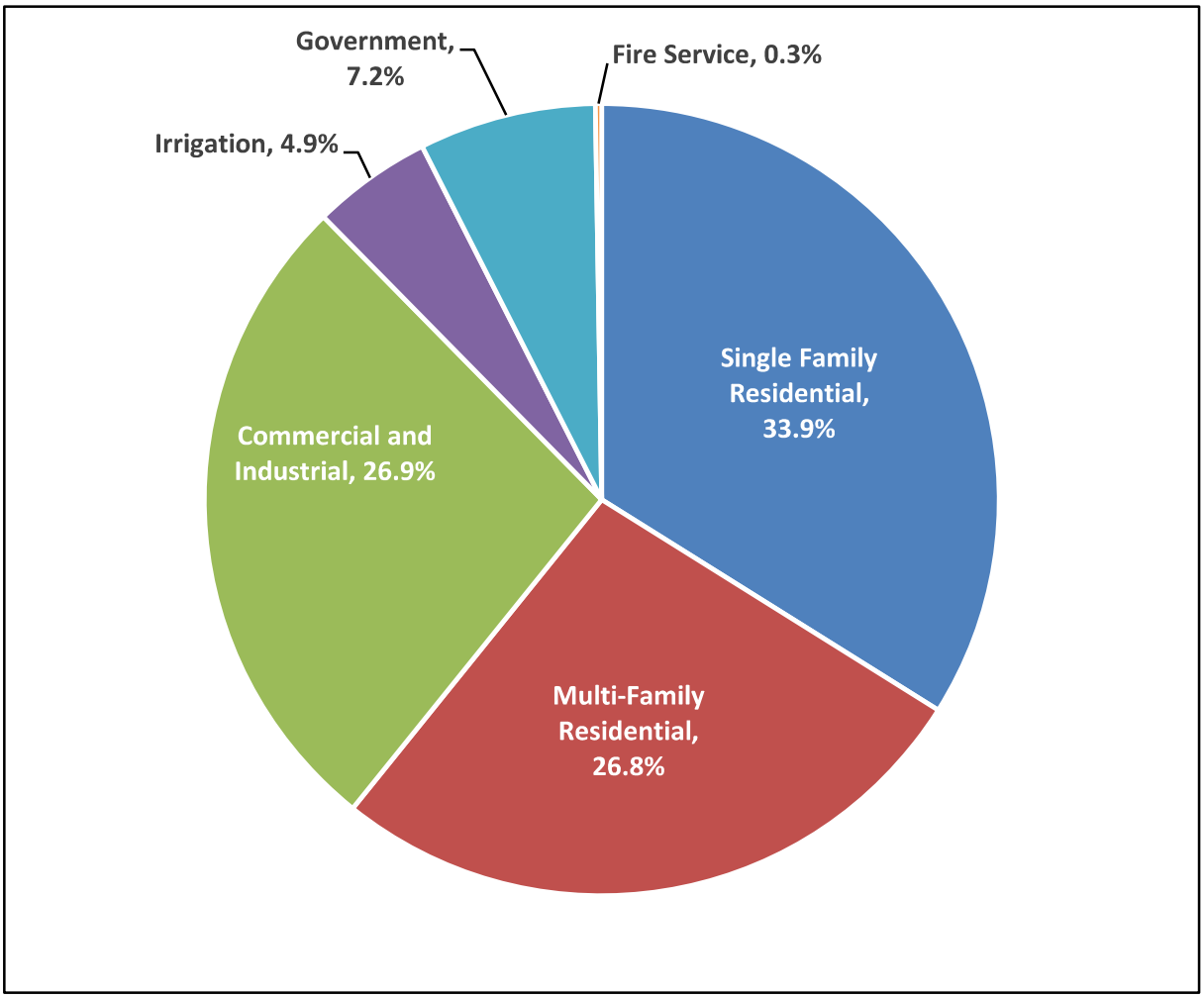
Customer Class	Consumption (MG)						
	2013	2014	2015	2016	2017	2018	Avg. (2013–2018)
Single family (metered) [a]	418.8	468.8	539.7	608.5	821.9	854.6	618.7
Single family (flat/non-metered) [b,c]	721.7	665.5	570.1	421.7	314.8	207.8	483.6
Single family outside city (metered)	101.3	98.5	97.2	93.7	107.8	96.2	99.1
Single family subtotal	**1,241.7**	**1,232.8**	**1,207.1**	**1,123.9**	**1,244.5**	**1,158.6**	**1,201.4**
Multifamily	982.2	979.2	920.3	932.7	988.3	881.2	947.3
Multifamily outside city	3.3	3.3	3.2	3.2	4.1	3.9	3.5
Multifamily subtotal	**985.5**	**982.5**	**923.4**	**936.0**	**992.4**	**885.1**	**950.8**
Commercial	683.2	677.4	655.4	681.4	703.3	656.7	676.2
Commercial outside city	6.8	5.0	6.3	6.1	8.3	8.6	6.9
Industrial	331.5	321.3	255.8	251.4	243.5	209.7	268.9
Commercial/industrial subtotal	**1,021.5**	**1,003.7**	**917.5**	**938.9**	**955.1**	**875.0**	**951.9**
City of Everett metered	20.9	24.2	24.1	18.4	16.6	14.3	19.8
City of Everett streets sewer	8.2	8.7	8.3	58.7	72.7	62.2	36.5
City of Everett parks	19.0	21.8	25.4	21.3	27.7	29.2	24.1
City of Everett irrigation	46.3	56.1	64.7	41.1	53.1	60.9	53.7
City of Everett: not self-consumed	0.9	0.9	0.8	0.8	0.7	0.7	0.8
City of Everett fire service: not self-consumed	0.0	0.0	0.0	0.0	0.0	0.0	0.0
City of Everett fire service	0.0	0.0	0.0	0.0	0.0	0.1	0.0
City of Everett subtotal	**95.3**	**111.7**	**123.4**	**140.4**	**170.7**	**167.4**	**134.8**
Fire service	10.7	12.8	9.5	7.4	6.9	7.5	9.1
Fire service outside city	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Government	142.0	140.0	110.6	102.5	116.0	108.7	119.9
Government outside city	0.4	0.5	0.3	0.4	0.3	0.4	0.4
Domestic irrigation	38.2	40.7	47.7	41.2	50.2	47.8	44.3
Single family irrigation	0.0	0.0	0.1	0.0	0.4	0.5	0.2
Government irrigation	33.0	35.7	31.3	21.9	24.6	27.8	29.1
Commercial irrigation	80.6	85.0	102.2	95.8	113.8	111.1	98.1

Table 3-4. Water Sales by Customer Class in Everett's Retail Service Area (2013–2018)

Customer Class	Consumption (MG)						
	2013	2014	2015	2016	2017	2018	Avg. (2013–2018)
Industrial irrigation	0.4	0.6	1.1	0.9	0.6	0.6	0.7
Commercial irrigation outside city	0.0	0.0	0.0	0.3	0.2	0.5	0.2
Government irrigation outside city	0.6	0.6	0.5	0.6	0.5	0.7	0.6
Irrigation subtotal	**152.8**	**162.7**	**183.0**	**160.7**	**190.3**	**189.0**	**173.1**
Kimberly-Clark [d]	9.6	0.1	--	--	--	--	1.6
Totals	**3,659.5**	**3,646.8**	**3,474.9**	**3,410.0**	**3,676.2**	**3,391.6**	**3,543.2**
Average day sales (mgd)	**10.0**	**10.0**	**9.5**	**9.3**	**10.1**	**9.3**	**9.7**

[a] Significant upward trend in demand is due to conversion of unmetered single-family connections to metered connections.
[b] Unmetered demands estimated by applying a water use factor per metered single-family connection, based on average annual consumption per connection.
[c] Significant downward trend in demand is due to conversion of unmetered single-family connections to metered connections.
[d] Everett ceased selling water to the Kimberly-Clark paper mill in 2014.

Figure 3-2. Relative Proportion of Consumption by Customer Class in Everett's Retail Service Area (average of 2013–2018)



Wholesale

Table 3-5 lists sales to Everett's wholesale water customers, which are all separate public water systems in Snohomish County. All Group A customers are listed separately. Group B customers are combined into a single line item.

Wholesale customers are arranged in the table in order of quantity of water sold in 2018. The AWWD is by far the largest single customer, receiving approximately 70 percent of total wholesale deliveries from 2016 to 2018. AWWD consumes a portion of this water in its own service area, and delivers water to other water systems (i.e., indirect wholesale). The City of Marysville and Snohomish County PUD No. 1 purchase comparable amounts of water and have each been the second and third largest purchasers of wholesale water in the 2013–2018 period. From 2016–2018, Marysville purchased approximately 9 percent of the water delivered to wholesale customers by Everett, and Snohomish County PUD No. 1 purchased approximately 8.5 percent of the water delivered to wholesale customers from Everett. The remaining wholesale customers (including Group B systems) range from sizable communities to small

subdivisions, and collectively received approximately 13.5 percent of the wholesale water delivered from the Everett system.

Table 3-5. Wholesale Water Connections and Sales

Wholesale Customer	Wholesale Customer Sales (MG)								
	Points of Connection to Everett System	2013	2014	2015	2016	2017	2018	6-year Average	3-year Average
AWWD	3	9,367.3	10,886.3	10,392.4	9,485.8	10,513.8	10,521.4	10,194.5	10,173.6
City of Marysville	1	1,150.5	1,116.2	1,477.8	1,440.9	1,303.5	1,202.0	1,281.8	1,315.5
Snohomish County PUD No. 1	12	1,495.5	1,140.2	1,147.1	1,115.6	1,442.6	1,171.0	1,252.0	1,243.1
City of Monroe	3	800.2	741.2	729.2	744.6	881.9	726.0	770.5	784.2
Tulalip Tribes WS [a]	1	--	--	--	--	209.7	319.9	264.8	292.4
City of Snohomish [b]	5	235.1	197.1	167.7	219.4	287.1	263.4	228.3	256.6
Mukilteo WWD	2	213.2	162.5	177.7	159.6	140.2	143.2	166.1	147.7
Roosevelt Water	3	101.9	89.2	99.8	94.8	105.3	115.1	101.0	105.1
Highland WD	5	106.8	90.8	102.6	90.5	105.8	103.7	100.1	100.0
Silver Lake WSD	1	93.1	91.2	102.5	74.5	90.6	72.8	87.5	79.3
Three Lakes Water	2	68.9	59.0	64.9	62.4	78.0	54.6	64.6	65.0
Cross Valley WD	5	56.6	53.3	52.2	56.0	69.4	52.2	56.6	59.2
Group B water systems [c]	N/A	22.6	19.1	19.5	18.0	22.5	17.7	19.9	19.4
Machias Ridge Estates HOA	1	15.8	15.2	17.0	13.5	17.7	14.5	15.6	15.2
City of Sultan	1	8.2	11.1	8.5	16.9	13.5	9.0	11.2	13.2
Wilkshire Lane WD	1	8.3	7.2	11.0	6.7	7.9	7.5	8.1	7.4
Sultan Estates Water	1	7.1	5.9	6.6	5.5	6.6	5.8	6.2	6.0
Schluter Water	1	5.7	5.2	7.1	7.3	8.1	5.3	6.4	6.9
Circle H Mobile Home Park	1	6.8	6.4	6.1	6.0	7.1	5.2	6.3	6.1
Pilchuck Riviera WD	1	5.6	3.2	4.4	4.7	6.8	4.4	4.9	5.3
Fobes District Water	1	3.6	3.6	3.4	3.4	4.7	4.0	3.8	4.0
Meadow Lake WA	1	4.2	3.4	3.8	3.7	3.6	3.4	3.7	3.6
Pilchuck 26 Tracts WA	1	2.2	2.2	2.2	1.3	2.0	3.3	2.2	2.2
North Ridge Water	1	3.8	3.3	3.4	3.5	4.0	3.2	3.5	3.6
Riverside Water District #1	1	3.4	3.3	3.4	1.2	3.6	3.1	3.0	2.6
Northwest	1	2.6	2.1	2.9	2.3	2.7	2.4	2.5	2.5
Blackman's Lake Water	1	2.4	2.1	2.5	2.6	2.8	1.9	2.4	2.4
Plantation Park WS	1	3.4	3.1	2.1	1.8	2.1	1.8	2.4	1.9
Rivershore Water District #1	1	1.4	1.2	1.5	1.2	2.1	1.6	1.5	1.6
Twin Roads WA	1	2.1	1.7	1.9	1.5	1.6	1.3	1.7	1.5
Bunk Foss Water	1	1.6	1.4	1.9	1.6	1.3	1.0	1.5	1.3

Table 3-5. Wholesale Water Connections and Sales

Wholesale Customer	Wholesale Customer Sales (MG)								
	Points of Connection to Everett System	2013	2014	2015	2016	2017	2018	6-year Average	3-year Average
Woods Creek WD	1	0.7	0.7	0.8	0.8	1.1	0.8	0.8	0.9
Aldercrest Water [d]	1	*No data*							
Total	63	13,801	14,728	14,624	13,648	15,349	14,842	14,675	14,729
Total (mgd)		37.81	40.35	40.07	37.29	42.05	40.66	40.21	40.35

HOA = Home Owners' Association, WA = Washington, WD = Water District, WS = water supply, WSD = Water Supply District, WWD = Woodinville Water District

[a] Everett began serving the Tulalip Tribes WS in 2017. Therefore, the averages displayed in the two far right columns are the average of 2017 and 2018, rather than 3- and 6-year averages.

[b] Significant increase of purchased water in 2017 due to the permanent shutdown of the City of Snohomish's Pilchuck River supply that year.

[c] Includes all Group B systems. No single Group B system purchases more water than any Group A system.

[d] No data received for Aldercrest Water. Data in prior CWPs suggest that Aldercrest consumption is similar to that of the minor consumers near the bottom of the list and will have a minor impact to the overall wholesale demand. Additionally, Aldercrest began the process of consolidating into the City of Snohomish in 2017 and is inactive as of July 2019.

Aggregated Demands

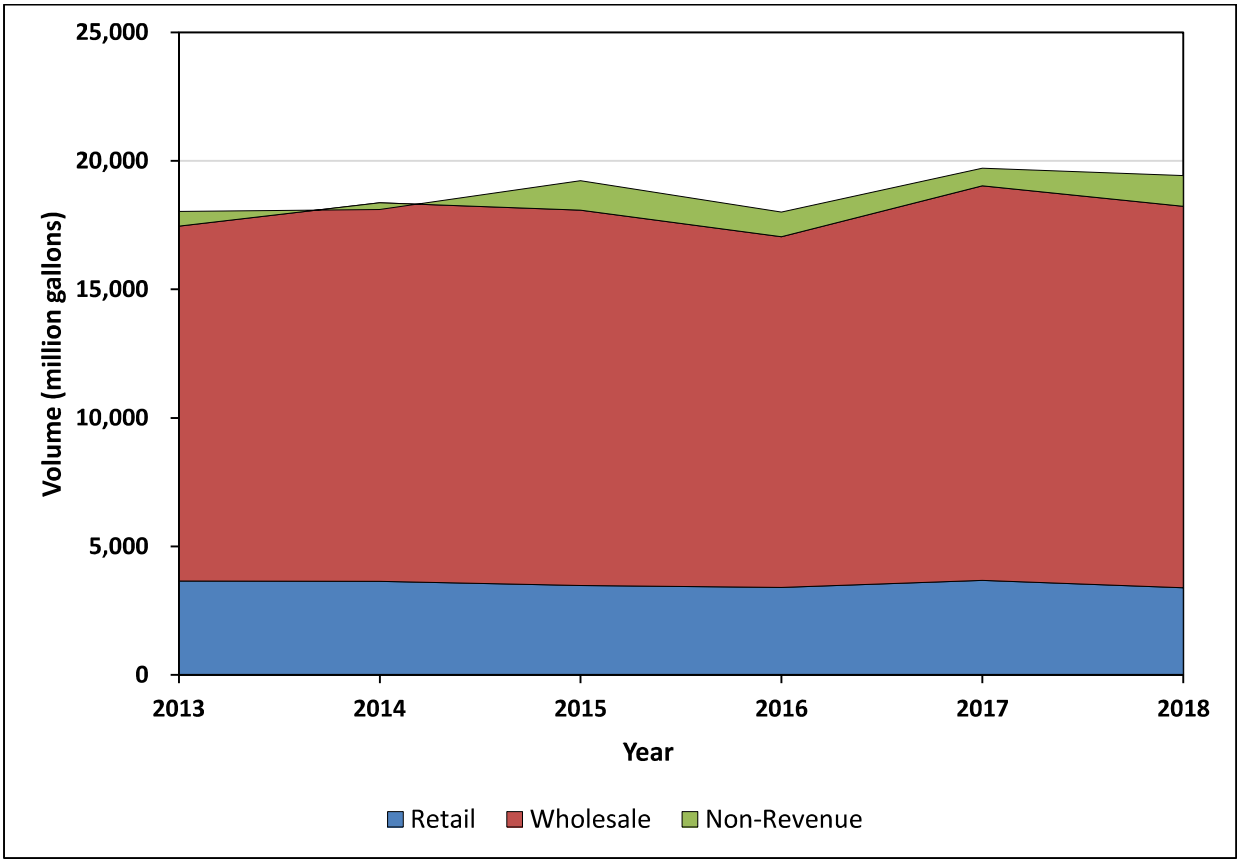
Approximately 20 percent of the potable water produced at the WFP is delivered to customers in Everett's retail service area. Approximately 80 percent is delivered to wholesale customers. The difference between water produced and water sold is considered non-revenue water, representing both unbilled uses and system losses in Everett's transmission and distribution system. Table 3-6 summarizes the aggregated retail and wholesale demands in comparison to total water production, which results in the non-revenue water quantity. Figure 3-3 presents historical retail and wholesale water sales from 2013–2018.

Table 3-6. Historical Annual Production, Retail and Wholesale Water Sales, and Non-Revenue Portion (MG, 2013–2018)

Category	2013	2014	2015	2016	2017	2018
Total production	18,031	18,110	19,229	18,010	19,717	19,427
Retail sales	3,660	3,647	3,475	3,410	3,676	3,392
Wholesale sales	13,805	14,730	14,604	13,646	15,352	14,845
Total sales	17,465	18,377	18,079	17,056	19,029	18,237
Non-revenue	566	(268)	1,149	954	688	1,190

Note: Non-revenue water is calculated as the difference between total production and total water sales. The negative value in 2014 is attributed to metering inaccuracies in the clearview meter which have been corrected.

Figure 3-3. Historical retail and Wholesale Water Sales (2013–2018)



3.3.3 Water Balance

A water balance compares production, or system input volume, with the sum of customer consumption and system losses. Table 3-7 displays Everett's water balance for 2018. This table is a slightly modified version of the format recommended for use by the American Water Works Association[3].

Table 3-7. Everett Water Balance (2018)

	Level 1	Level 2	Level 3	Volume (MG)	Percent of Produced and Purchased Water
Water produced	Revenue water	Billed authorized consumption	1. Billed water exported [a]	14,845	76
			2. Billed metered consumption [b]	3,184	16
			3. Billed unmetered consumption [c]	208	1
	Non-revenue water	Unbilled authorized consumption	4. Unbilled metered consumption [d]	0	0
			5. Unbilled unmetered consumption [e]	26	0
		Apparent losses	6. Unauthorized consumption [d]	0	0
			7. Customer metering inaccuracies [d]	0	0
		Real losses	8. Known leakage [d]	0	0
			9. Assumed leakage [f]	1,164	6
Total				19,427	100 [g]

[a] Sales to wholesale customers.

[b] All measured consumption in the retail service area.

[c] Estimated values for non-measured customers. See Table 3-4 above for methodology.

[d] No data.

[e] Values provided by Everett on 9/10/2019.

[f] Everett does not track items 4, 6, 7, and 8. Therefore, item 9 represents all unknowns.

[g] Values in the "Percent of Produced and Purchased Water" column do not add to 100% because of rounding errors. 100% displayed in this cell to show that all water is accounted for.

The water balance allocates the water produced to different categories at the following three levels:

- **Level 1:** Allocates the total water produced to either revenue water or non-revenue water. As implied by the names, revenue water is water that is delivered to customers and generates income while non-revenue water is water that may or may not be delivered to customers but does not generate income. Non-revenue water includes both unbilled authorized consumption and water losses. This is helpful in understanding what percentage of water production generates income for water system operations.
- **Level 2:** Divides non-revenue water into the following three sub-categories, which are useful in identifying potential additional revenue sources and identifying the magnitude of leaks or other losses that could be addressed:

[3] M36 Water Audits and Loss Control Programs, Fourth Edition. American Water Works Association. 2016.

- **Unbilled authorized consumption:** Includes uses such as water system flushing and firefighting. Everett standard practice is not to charge for uses falling into this sub-category. However, it is always a prudent practice to review these uses to ensure that a legitimate revenue opportunity is not missed. The City estimates that less than 1 percent of production has been unbilled authorized consumption.
- **Apparent losses:** Includes unauthorized uses and customer meter inaccuracies, both of which are potential lost revenue opportunities.
- **Real losses:** Includes various types of system leaks. A certain level of leakage is unavoidable; however, leakage beyond that level should be repaired, if cost-effective, to avoid unduly burdening both the natural resource and the physical infrastructure. Any amount that cannot be assigned to another category is considered a real loss under the American Water Works Association's protocol, and is included in the formula for calculating distribution system leakage under Washington State's Water Use Efficiency Rule.

- **Level 3:** Further splits water into additional sub-categories to support further estimation and water management practices.

3.3.4 Large-Volume Water Customers

Table 3-8 presents the 20 customers with the largest demands by volume in 2019. These customers consumed 755.2 MG (approximately 2.1 million gallons per day [mgd]) in total. Consumption data for the entire Everett retail system for 2019 were not used in the analysis but, when compared with the average of total retail demands from 2013–2018 (Table 3-4 above), the 20 largest customers consume approximately 21 percent of retail sales.

Table 3-8. Twenty Largest Retail Customers by Volume of Water Consumed, 2019 [a]

Retail Customer	2019 Potable Water Sales (MG)
Boeing Co.	186.8
Everett, City of	127.0
Stockpot Inc.	96.6
Everett School District	91.7
Everett Housing Authority	34.8
Trident Seafoods/Port Chatham	24.0
Port of Everett	22.5
Overall Laundry	22.3
Olin Fields Apts.	20.4
Armco Mgmt. Co.	17.0
Crystal Springs Apts.	14.5
Williams Investments	13.6
Casa Blanca II	13.4
Prime Catalina Merrill Creek LLC	12.6
Wildreed Apartment Homes	11.7
The Bluff at Evergreen	10.9
Greens of Merrill Creek	10.5

Table 3-8. Twenty Largest Retail Customers by Volume of Water Consumed, 2019 [a]

Retail Customer	2019 Potable Water Sales (MG)
Bluwater	10.0
Parkside Acquisition Preservation	7.8
Achilles	7.1
Total	**755.2**

[a] Data provided on 3/11/2020 by City of Everett.

In the 2007 CWP, Everett concluded that large-volume water customers do not need to be itemized in the updated forecast. This is the same as in the 2014 CWP Addendum. The 2020 CWP does not evaluate large-volume water customers separately from the overall water use data available for the purposes of water demand forecasting.

3.3.5 Water Use Factors

A water use factor is a measure of water use per unit, such as water use per household or water use per employee. This information can be used when evaluating facilities and can be combined with demographic data in developing the demand forecast.

Equivalent Residential Units

The use of equivalent residential units (ERU) is a method to relate all types of water uses as an equivalent use by single-family households. One ERU represents the average amount of water consumed by a single-family household and is calculated by dividing the system-wide total single-family water consumption by the number of single-family connections. Table 3-9 summarizes single-family water consumption from 2013–2018, the number of single-family connections, and the calculated ERU values.

Table 3-9. Annual ERU Values for Everett Retail Customers and Multi-Year Averages

Parameter	2013	2014	2015	2016	2017	2018	3-year Average	4-year Average	5-year Average	6-year Average
SFR [a] annual consumption (MG)	1,242	1,233	1,207	1,124	1,244	1,159	1,176	1,183	1,193	1,201
SFR [a] connections	20,665	20,783	20,980	21,153	21,461	21,657	21,424	21,313	21,207	21,117
Gal/ERU	60,089	59,318	57,535	53,130	57,987	53,497	54,871	55,537	56,293	56,926
gpd/ERU	165	163	158	145	159	147	150	152	154	156

[a] SFR = single-family residential customer class.

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The ERU water use value has had a downward trend between 2013 and 2018. The 3-year average (2016–2018) of 150 gallons per day (gpd) per ERU is the most representative of ERU values in recent years, and therefore is chosen as the updated ERU value.

The 2014 CWP Addendum calculated water use of 171 gpd per ERU. The decline in single-family water use is consistent with the experience of other water systems in the region. It is influenced by many factors, such as improved measurement of water use through continued conversion of non-metered customers to metered customers, conservation efforts, continued replacement of older plumbing fixtures, rising water rates, and economic conditions.

Per Capita Factor

Everett uses a per capita factor for customers in the retail service area to forecast retail water demands. Per capita water use for Everett was obtained by dividing total retail water use by total retail service area population. The 2014 CWP Addendum demand forecast was based upon a water use factor of 90 gallons per capita per day (gpcd). Everett calculated a new per capita water use factor to reflect updated consumption values and only in the retail service area (Table 3-10).

Table 3-10. Annual Per Capita Water Use Factors and the Share of Factor between the Three Major Customer Categories

Parameter	2013	2014	2015	2016	2017	2018
Water system population (retail service area)	108,420	109,130	110,069	112,649	114,206	115,608
Single family per capita demand (gpcd)	31	31	30	27	30	27
Multifamily per capita demand (gpcd)	25	25	23	23	24	21
Industrial/Commercial/Institutional/other per capita demand (gpcd)	36	36	33	33	35	32
Total per capita water demand (gpcd)	**92**	**92**	**86**	**83**	**88**	**80**

The average of all 6 years of historical data provides a per capita water use factor of 86 gpcd. This value was used in the demand forecast.

3.4 Water Demand Projection Methodology

Water demand forecasts for the Everett system are an aggregate of projections for Everett retail demands, demands from current and future wholesale customers, and an estimate for non-revenue water. The methodology relies on using the most recent available population and demand data from Everett, Everett's current largest wholesale water customers and new wholesale customers (the City of Bothell and Tulalip Tribes), and water use factors derived from historical data. Demands for small direct wholesale customers were based on the demand forecasts developed for the 2014 CWP. Projections were developed for 2020, 2030, 2040, and a 100-year "buildout" planning horizons.

The following list describes the basis for the demand projection for the various customers and customer categories. The list includes information from utilities/customers that provided their internal demand forecast for use in the Everett total demand forecast:

- Everett retail demands: Everett retail demand forecast values were determined by applying the 86 gpcd water use factor to population projections presented in the 2015-2035 Everett Comprehensive Plan. Population projections in the Comprehensive Plan include an allocation for 5,700 additional people due to the arrival of light-rail stations in Everett as part of the Sound Transit 3 project. Population growth from 2035–2040 was based on the 2040 population projection for Everett in the Puget Sound Regional Council Land Use Vision database. The population projection in 2040 is above the estimated population capacity in the buildable-lands analysis stated in the Comprehensive Plan, so the buildout water demand value in the retail service area was assumed to be equivalent to the 2040 population estimate. Table 3-11 displays a summary of the population estimates in critical years of the planning horizon.

Table 3-11. Everett Retail Service Area Population Estimates for the Base-year (2020), 10-year (2030), and 20-year (2040) Planning Horizons

Parameter	Retail Service Area Population		
	2020	2030	2040
Inside city [a]	116,469	146,801	182,303
Outside city [b]	4,617	5,820	7,227
Additional population [c]	0	0	5,700
Total	**121,086**	**152,621**	**195,230**

[a] Population forecasts inside city limits developed by interpolating population between the 2018 OFM estimate and 2035 estimate in the Everett 2035 Comprehensive Plan using a compound growth rate.

[b] Population forecasts outside city limits developed by applying the growth rate developed inside city limits to the "outside city" population in Table 3-2 above.

[c] Population growth due to light-rail station opening in Everett retail service area as part of Sound Transit 3 project.

- **Alderwood Water and Wastewater District:** Demands are based on demand forecast values in AWWD's 2017 Water System Plan. AWWD demands include indirect wholesale customers Lynnwood, Edmonds, Mountlake Terrace, Silver Lake, and Clearview Water Supply Agency demands. Linear interpolation was used to derive values presented in this forecast that were not specifically stated in the AWWD plan.
- **Snohomish County PUD No. 1:** Snohomish County PUD No. 1 was working to update its 2011 Water System Plan during the 2020 CWP update. The PUD provided Everett-specific demand forecast values for incorporation.
- **City of Marysville:** Demands are based on demand forecast values in Marysville's 2016 Water System Plan, which includes estimated Snohomish County PUD and

Tulalip Tribes water use from the shared JOA transmission line. Approximately 70 percent of Marysville demands are accounted for in the JOA pipeline (Everett Supply). Thus, 70 percent of forecasted demand was used to estimate the Everett portion, then the PUD-portion of the JOA-line use was subtracted from this amount to avoid double-counting water that is included in Snohomish County PUD No. 1's forecast (above).

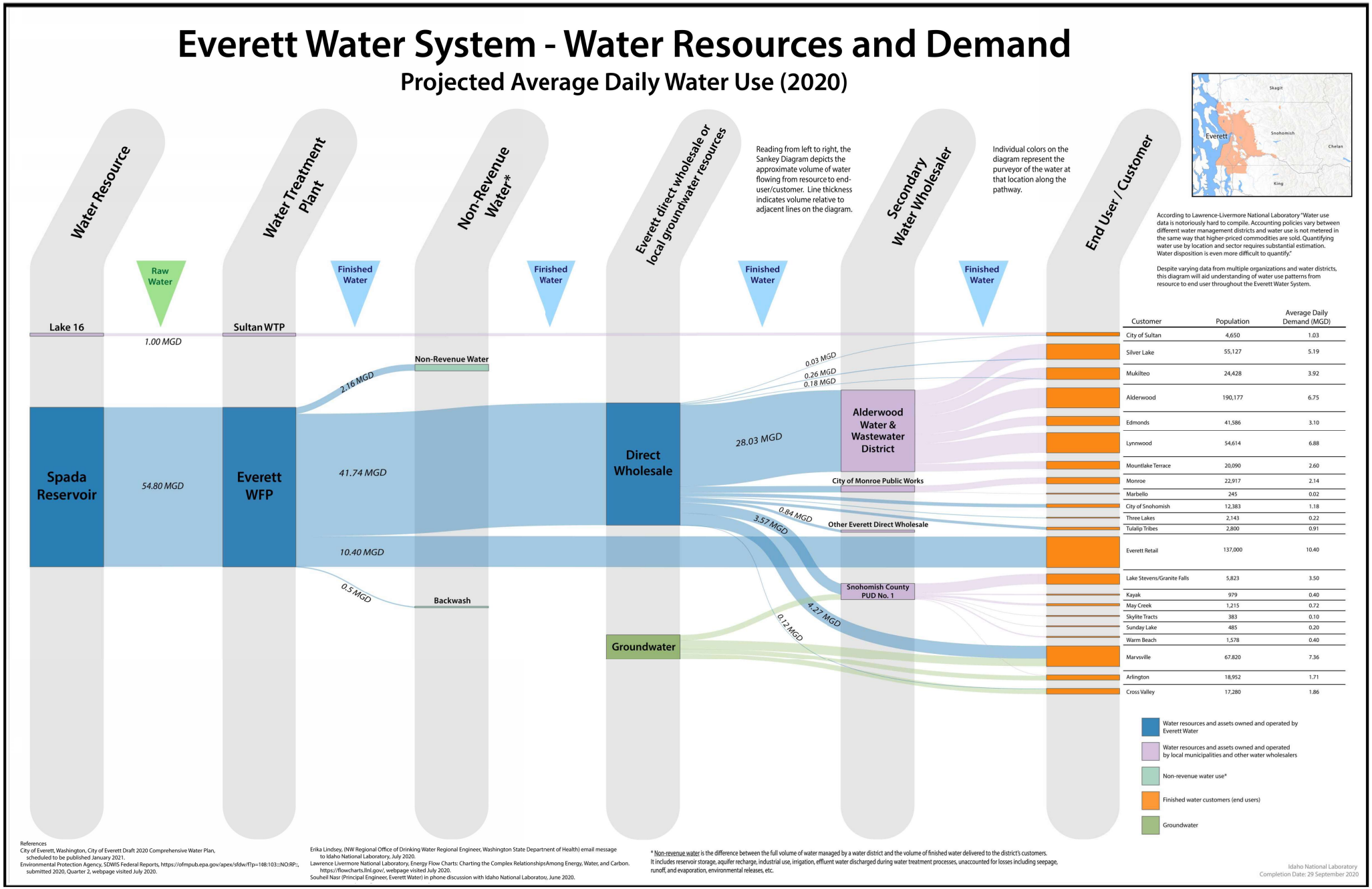
- **City of Monroe:** Demands are based on demand forecast values in Monroe's 2015 Water System Plan.
- **City of Snohomish:** Snohomish purchases all of its water from Everett except for a small portion from the PUD. This small portion was subtracted from total demand to determine the Everett-supplied portion of demand.
- **Tulalip Tribes:** Demand forecast is based on linear interpolation of current demands to full contractual delivery quantities in 2100. The Tulalip Tribes currently purchases approximately 0.55 mgd from Everett.
- **Silver Lake:** Demands are based on demand forecast values in Silver Lake's 2010 Water Master Plan and the assumption that Everett serves 5 percent of Silver Lake's demands.
- **Mukilteo:** Demands are based on demand forecast values in Mukilteo's 2015 Water Master Plan and the assumption that Everett serves 7.5 percent of Mukilteo's demands.
- **Cross Valley:** No additional information for the Cross Valley Water System demand forecast was available during the planning process. Demands were based on the Cross Valley demand forecast in the Everett 2014 CWP Addendum.
- **City of Sultan:** Demands are based on demand forecast values in Sultan's 2018 Water System Plan and the assumption that Everett serves 4.7 percent of Sultan's total demand.
- **Three Lakes Water District:** Demands are based on demand forecast values in Three Lakes' 2013 Water System Plan. Everett serves all of Three Lakes' water demand.
- **Other direct wholesale:** Demand forecast is based on demands forecasted in the Everett 2014 CWP Addendum. In the years since the 2014 CWP Addendum, wholesale demands have grown slower than the rates previously forecasted. Thus, the demand forecast developed in the 2014 CWP Addendum represents a conservative forecast and is carried forward into the new CWP. These customers represent 2.5 percent of total wholesale demand. See Appendix G for a list of all the additional customers in the category.
- **Bothell:** The City of Bothell plans to convert its source from Seattle Public Utilities to Everett in the future. Bothell must provide a 5-year notice to Seattle Public Utilities before it begins to switch the source. Bothell has not provided that notice yet, and therefore is not included in the Everett demand forecast to 2030. Bothell demands are included in the 2040 forecast and buildout scenarios under "other direct wholesale." Demand forecast values were derived from Bothell's 2012 Water System Plan.

- **Non-revenue water:** The percentage of non-revenue water used for demand forecasting is calculated by subtracting wholesale deliveries and retail sales from total water production at the WFP and dividing the result by total sales. This value, termed "retail/transmission non-revenue," represents a combination of non-revenue uses and losses in Everett's distribution system and non-revenue losses in the transmission system that serves the entire region (retail plus wholesale). This figure does not include non-revenue uses and losses in individual water systems that purchase water from Everett. The non-revenue water projection is based on the historical data and estimates. The percentage of non-revenue water based on production was converted into a percentage based on sales. This percentage (4 percent) was then held constant throughout the forecasting period. The configuration of source meters in the Everett system does not permit differentiating non-revenue water in the transmission system from non-revenue water in the retail distribution system.
- **Peaking factor:** The system-wide peaking factor determined from historical data (1.76) was applied to both wholesale and retail customer ADDs. This is appropriate for Everett's demand forecast because with a high number of wholesale systems, it is unlikely that they will all experience their MDD on the same day, and thus an "average" peaking factor, as determined from Everett's production data, will be sufficient to forecast increased usage during summer months.

3.5 Water Demand Projections

The Sankey diagram shown in Figure 3-4 depicts the proportional flow of Everett's projected 2020 water supply from its source at Spada Reservoir through critical nodes, such as the water filtration plant, to the end user.

Figure 3-4. Everett Water System - Water Resources and Demand



Customer	Population	Average Daily Demand (MGD)
City of Sultan	4,650	1.03
Silver Lake	55,127	5.19
Mukilteo	24,428	3.92
Alderwood	190,177	6.75
Edmonds	41,586	3.10
Lynnwood	54,614	6.88
Mountlake Terrace	20,090	2.60
Monroe	22,917	2.14
Marbello	245	0.02
City of Snohomish	12,383	1.18
Three Lakes	2,143	0.22
Tulalip Tribes	2,800	0.91
Everett Retail	137,000	10.40
Lake Stevens/Granite Falls	5,823	3.50
Kayak	979	0.40
May Creek	1,215	0.72
Skylite Tracts	383	0.10
Sunday Lake	485	0.20
Warm Beach	1,578	0.40
Marysville	67,820	7.36
Arlington	18,952	1.71
Cross Valley	17,280	1.86

References
City of Everett, Washington, City of Everett Draft 2020 Comprehensive Water Plan, scheduled to be published January 2021.
Environmental Protection Agency, SDWIS Federal Reports, https://ofmpub.epa.gov/apex/sfdw/f?p=108:103::NO:RP:, submitted 2020, Quarter 2, webpage visited July 2020.
Erika Lindsey, (NW Regional Office of Drinking Water Regional Engineer, Washington State Department of Health) email message to Idaho National Laboratory, July 2020.
Lawrence Livermore National Laboratory, Energy Flow Charts: Charting the Complex RelationshipsAmong Energy, Water, and Carbon. https://flowcharts.llnl.gov/, webpage visited July 2020.
Souheil Nasr (Principal Engineer, Everett Water) in phone discussion with Idaho National Laboratory, June 2020.

* Non-revenue water is the difference between the full volume of water managed by a water district and the volume of finished water delivered to the district's customers. It includes reservoir storage, aquifer recharge, industrial use, irrigation, effluent water discharged during water treatment processes, unaccounted for losses including seepage, runoff, and evaporation, environmental releases, etc.

Idaho National Laboratory
Completion Date: 29 September 2020

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Water demand forecasts for 2020 through 2040 for the entire service area are shown in Table 3-12. Table 3-13 displays the maximum day demand forecast for the same period. The forecasts presented here, which do not assume future savings from conservation activities, will be used for planning and development of regional facilities. In addition, the forecast for Everett's own retail service area will be used in modeling hydraulic conditions and identifying system needs within Everett's local distribution system.

The forecasts have been developed for purposes of system-wide planning. Forecasts prepared for individual water systems that receive water from Everett, which are reflected in the total demand projections, may have additional details or assumptions that are not shown or described here. Forecasts and infrastructure planning for these systems should be based on local planning and development data and assumptions.

Table 3-12. Everett Retail and Current Wholesale Customer Average Day Demand Forecast (without conservation savings)

Customer	Average Day Demand (mgd)		
	2020	2030	2040
Everett retail service area	10.4	13.1	16.8
Direct Wholesale			
AWWD	28.03	30.70	31.83
Snohomish County PUD No. 1	3.57	4.62	5.89
City of Marysville	4.27	5.01	5.87
City of Monroe	2.16	2.41	2.63
City of Snohomish	0.97	1.10	1.21
Tulalip Tribes	0.91	4.55	8.19
Subtotal direct wholesale: large customers	39.92	48.39	55.62
Silver Lake	0.26	0.28	0.29
Mukilteo	0.14	0.16	0.18
Cross Valley	0.12	0.14	0.16
City of Sultan	0.03	0.04	0.04
Three Lakes Water District	0.22	0.26	0.29
Other direct wholesale	0.84	0.99	3.47 [a]
Subtotal wholesale	41.53	50.25	60.05
Non-revenue water	2.16	2.64	3.21

Table 3-12. Everett Retail and Current Wholesale Customer Average Day Demand Forecast (without conservation savings)

Customer	Average Day Demand (mgd)		
	2020	2030	2040
Total system demand	**54.1**	**66.0**	**80.0**
Equivalent population served at 86 gpcd	629,509	767,988	931,233

[a] Bothell water demands included in 2040 forecast.

Table 3-13. Everett Retail and Current Wholesale Customer Maximum Day Demand Forecast (without conservation savings)

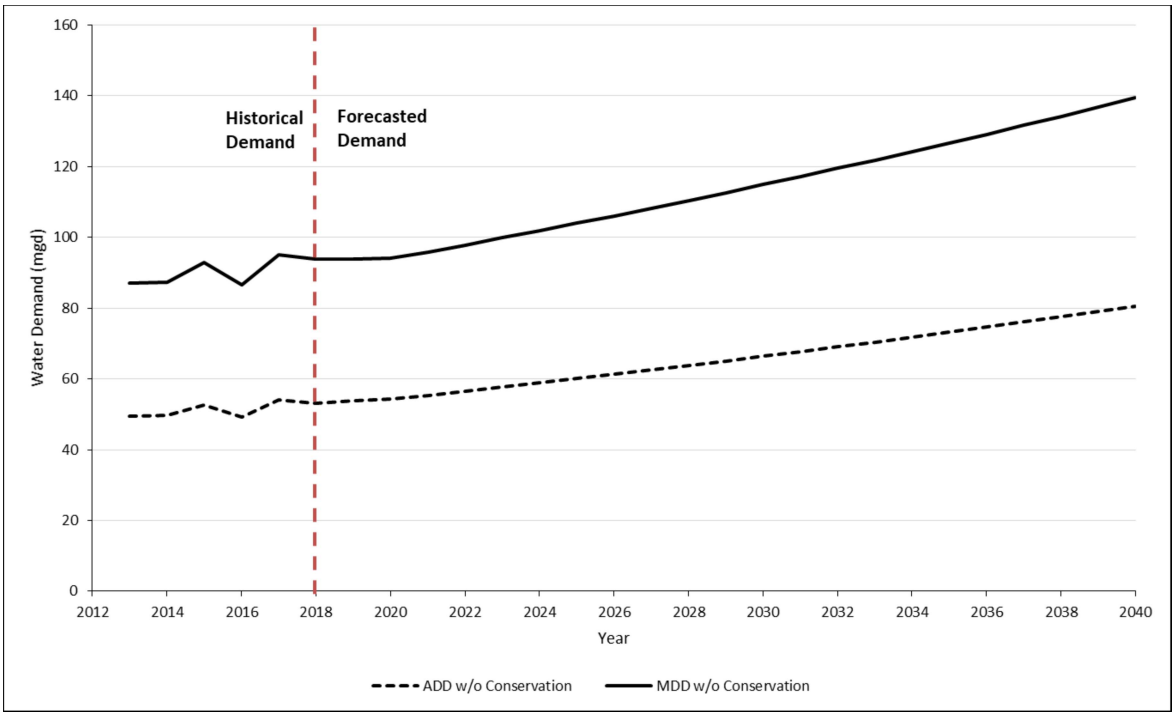
Customer	Maximum Day Demand (mgd)		
	2020	2030	2040
Everett retail service area	18.3	23.1	29.5
Subtotal wholesale	73.15	88.50	105.78
Non-revenue water	2.15	2.63	3.18
Total system demand	**93.6**	**114.2**	**138.5**

Without considering savings from plumbing code changes or conservation, ADD is projected to increase from 54.1 mgd to 80.0 mgd between 2020 and 2040 because of significant population growth. MDD is projected to increase from 93.6 mgd to 138.5 mgd over the same period, based on a peaking factor of 1.76. Each represents approximately a 48 percent increase in demand. Figure 3-5 graphically depicts historical water demand from 2013–2018 and forecasted demand growth from 2020–2040.

Within Everett's retail service area, ADD is projected to increase by 62 percent from 10.4 mgd in 2020 to 16.8 mgd in 2040. MDD is also projected to increase by the same percentage during this period, from 18.3 mgd to 29.5 mgd.

The bottom row of Table 3-12 above shows estimated equivalent population served by the Everett regional water system, calculated by dividing the total system demand by 86 gpcd. Snohomish County County-wide Planning Policies forecast a countywide population of approximately 899,800 in 2030, and approximately 1,014,000 in 2040. Table 3-12 above suggests that Everett will serve approximately 86 percent of the population in 2030, and 93 percent of the population in 2040.

Figure 3-5. ADD and MDD Forecast through 2040 without Conservation



3.6 Other Factors Influencing the Demand Forecast

The following factors also influence the demand forecast for the Everett water system.

Buildout. Everett considered water demands for several year 2100 "buildout" scenarios to determine if water rights and sources will be adequate for long-range planning. Buildout scenarios were developed by applying compound growth rates to forecasted 2040 demands through 2100. Table 3-14 displays the results of this analysis.

Table 3-14. Forecasted Water Demands for Buildout Scenarios (mgd)

Customer	2040 Demands	2040–2100 Compound Growth Rate Scenario (percent growth)				
		0.20%	0.40%	0.60%	0.80%	1.00%
Everett retail	16.77	18.91	21.31	24.01	27.05	30.47
Subtotal wholesale	60.05	70.33	79.27	89.32	100.62	113.33
Non-revenue water	3.18	3.59	4.05	4.56	5.13	5.78
Total system demand	**80.00**	**92.82**	**104.62**	**117.89**	**132.81**	**149.58**
Equivalent population served at 86 gpcd	**931,233**	**1,080,496**	**1,217,819**	**1,372,267**	**1,545,937**	**1,741,175**

Conservation and Code Savings. Water demands can be reduced through water conservation programs and efficiency of water-using equipment related to Washington State's plumbing code. These elements are discussed and analyzed separately in the conservation section of the CWP (Chapter 5). Conservation and code savings are subtracted from the system-wide demand forecast to yield a conservation-adjusted forecast. This has the same effect as if the water use factors for each individual system were adjusted to account for conservation and code savings.

Table 3-15 displays forecasted savings from the Everett conservation program.

Table 3-15. Everett Conservation Program Forecasted Savings

Customer	Average Day Demand (mgd)				Maximum Day Demand (mgd)			
	2020	2030	2040	Build Out	2020	2030	2040	Build Out
Total Demand Without Conservation Savings	54.1	66.0	80.0	142.3	93.6	114.2	138.5	246.3
Conservation Savings	0.12	1.20	1.20	1.20	0.12	1.20	1.20	1.20
Total Demand with Conservation Savings	**53.96**	**64.78**	**78.80**	**141.09**	**93.51**	113.03	137.31	245.15

New Wholesale Customers. There are currently no plans to sell water to additional wholesale customers beyond what is described in this CWP. However, water systems in Snohomish County may approach Everett for water service in the future. Adding wholesale customers would have an effect on the wholesale demand forecast, and the proportion of water supply sold to wholesale customers.

Capacity of Existing Wholesale Customers' Supplemental Water Supplies. Some wholesale customers operate their own water supplies in addition to purchasing water from Everett. As those water systems grow, use of their own sources will ultimately be maximized, and there will be limited options for developing new water sources. Therefore, beyond 2040, the percentage of Everett water used within these purchasing systems is likely to increase, adding to the 2040–2100 buildout water demands.